

### **REMARKS**

Applicants thank the Examiner for the very thorough consideration given the present application. Claims 1-3 and 5 are currently pending in this application. Claims 4 and 6 have been cancelled. No new matter has been added. For instance, the amendment to claim 2 is supported by, for example, Figure 2 in the Specification. Accordingly, no new matter has been added.

In view of the amendments and remarks herein, as well as the remarks filed on June 22, 2010, incorporated herein by reference in their entirety, Applicants respectfully request that the Examiner withdraw all outstanding rejections and allow the currently pending claims.

#### **Issues Under 35 U.S.C. 103(a)**

Claims 1-6 stand rejected under 35 U.S.C. 103(a) as being obvious over Yokogawa et al. (U.S. 2003/0141518) (hereinafter “Yokogawa”) in view of Kashima et al. (JP 07-086162) (hereinafter “Kashima”). Applicants respectfully traverse.

Applicants submit that the Examiner has failed to establish a *prima facie* case of obviousness. As previously discussed, Yokogawa fails to teach or suggest a step of stopping the irradiation of the molecular beams and halting growth for a period of time until the remaining molecular beam intensity of the first group V element is reduced to be in the range of 0.01 to 0.1 of that in the first step. Contrary to the Examiner’s assertion, Kashima fails to cure the deficiencies of Yokogawa.

Initially, Applicants note that the Examiner has taken the position that some of the features which Applicants rely upon to traverse the outstanding rejection are not recited in the claims. Specifically, the Examiner notes, in response to Applicants’ previous argument that Kashima shows that the In supply is restarted before the supply of phosphine is started, that this

feature is not recited in the present claims. However, Applicants respectfully disagree and submit that this feature is in fact recited in independent claim 2.

The Examiner further notes that “the length of time is not claimed, merely the remaining molecular beam intensity” (see Advisory Action of July 13, 2010). However, Applicants respectfully submit that the degree of the molecular beam of the first V element supplied in a chamber in the first step being reduced by halting the supply in the second step, and the time to be spent for the reduction, may depend on various factors, such as structural and individual characteristics of the MBE apparatus, intensity of the molecular beam irradiation, and capacity of the vacuum retention and exhaust system in the chamber. Thus, the reduction amount of the first group V element is more accurate and specific than the period of time itself in defining the features of the present invention.

The Examiner contends that paragraph [0006] of Kashima teaches that the supply of a Group Va element is stopped during the time  $t_2$ . However, Applicants note that, although Kashima may teach that the supply of all the raw material gas, including the group Va element and the group IIIa element, is stopped during a time  $t_2$ , this reference teaches that only the group Va element is supplied for 2 seconds during  $t_1$ , which is clearly different from the present invention. According to the teachings of Kashima, the purpose of providing a period  $t_1$  of 2 seconds is to terminate the surface of the InGaAs thin film by the As surface (see par. [0007] in Kashima). Further, as to the period  $t_2$ , which lasts for 24 seconds, Kashima discloses that excessive As covering the surface of the InGaAs thin film is to be repeatedly evaporated so that the As coverage of the InP substrate (6) is adjusted to be 1 (1 molecular layer of As) during this period (see par. [0007]). Clearly, the purpose of time periods  $t_1$  and  $t_2$  in Kashima is completely different from the objectives achieved by the presently claimed first and second steps. In

Kashima, the time periods disclosed ensure that a specific amount of the group Va element remains on the surface. In contrast, the present invention defines the amount by which the remaining molecular beam intensity of the first group V element is to be reduced.

The Examiner also takes the position that the fact that the As beam intensity is reduced to 1/14 after only 1 second and is reduced into the claimed range after 50 seconds supports his contention that the molecular beam intensity in Kashima is reduced to 0.1 or less after 24 seconds. Applicants respectfully disagree. Kashima is silent as to the period of time during which the group Va element gas component is reduced so as to achieve a desired amount remaining in the chamber, while also stopping the supply of the raw materials to prevent the gas component from being mixed into the subsequently grown layer. Accordingly, even if Kashima were combinable in the manner suggested by the Examiner (which Applicants do not concede), such combination would still fail to achieve or render obvious the above described features as defined in present claims 1 and 2, or the advantageous effects obtained in the present invention by preventing the group Va element from being mixed into the etch stopper layer.

The Examiner further argues that Applicants have not shown the criticality of the claimed endpoints (0.1 and 0.01). In response to Applicants' previous argument that it takes at least 20 seconds for the remaining beam to be reduced to less than 0.01 when radiation is suspended, the Examiner takes the position that there is no evidence that 0.01 is a critical number. The Examiner's attention is directed to page 10, lines 20-24 of the Specification, where it is disclosed:

*"...it was then found out that when the growth of the InP layer was started after the intensity of the As molecular beam reaches 1/10 or less of the amount of As supplied during the growth of the InAlAs layer, the amount of As mixed was 0.05 or less in the composition."*

As evidenced by the above, when the growth of the InP layer is started after the intensity of the As molecular beam reaches 1/100 or less of the amount of As supplied during the growth of the InAlAs layer, the amount of As mixed would be 0.005 or less in the composition. Further, referring to FIG. 3, the etching rate of an InP layer which corresponds to an As mixed amount of 0.005 would be approximately 0.03nm/sec, and that which corresponds to an As mixed amount of 0 would be approximately 0.02nm/sec (shown at the Y-intercept). Since it is hardly conceivable that an As mixed amount of 0 could be achieved, the As mixed amount of 0.005, corresponding to the etching rate of an InP layer of 0.03nm/sec, would be considered as the end point for practical purposes (with measurement precision taken into consideration), and the corresponding As molecular beam intensity would therefore be 1/100.

Moreover, as to the criticality of the 0.1 endpoint, the Examiner's attention is directed to the present Specification at page 8 line 26 to page 9 line 8, where it is disclosed:

*"FIG. 3 shows the correlation between the amount of As mixed and the etching rate of the InP layer. For example, in the case of using a 3nm thick InP layer as the etch stopper layer, the etching rate is required to be less than 0.1 nm/sec in order to obtain resistance to the phosphoric acid type etchant for 30 sec or more. In this case, referring to FIG. 3, the amount of As mixed in the InP layer must be suppressed to 0.05 or less by composition thereof."*

Moreover, the Examiner's attention is directed to page 10, lines 20-24 of the Specification, where it is disclosed:

*"...it was then found out that when the growth of the InP layer was started after the intensity of the As molecular beam reaches 1/10 or less of the amount of As supplied during the growth of the InAlAs layer, the amount of As mixed was 0.05 or less in the composition, thus completing the present invention."*

The above-cited paragraphs in the present Specification provide sufficient evidence of the criticality of the claimed endpoints. Applicants reaffirm their previous position that the cited references fail to teach or in any way suggest the claimed endpoints.

The cited references, alone or in combination, fail to teach or suggest a method as claimed. For this reason alone, this rejection is improper and should be withdrawn. Moreover, as previously discussed, the present invention achieves superior and unexpected results, which rebuts any *prima facie* case of obviousness arguably established by the Examiner. As such, reconsideration and withdrawal of this rejection are respectfully requested.

### **Conclusion**

All of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicants therefore respectfully request that the Examiner reconsider all presently outstanding rejections and objections and that they be withdrawn. It is believed that a full and complete response has been made to the outstanding Office Action and, as such, the present application is in condition for allowance.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact Vanessa Perez-Ramos, Registration No. 61158 at the telephone number of the undersigned below to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Director is hereby authorized in this, concurrent, and future replies to charge any fees required during the pendency of the above-identified application or credit any overpayment to Deposit Account No. 02-2448.

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Respectfully submitted,

By 

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